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CASE REPORT

Transcatheter ablation through the cardiac veins in a patient with a biventricular device and left ventricular epicardial arrhythmias

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Left ventricular outflow tract (LVOT) may be a source of repeated premature ventricular complexes (PVCs). In symptomatic patients, radiofrequency catheter ablation (RFCA) can be effective, either from endocardial or from epicardial sites.
A 50-year-old patient, with dilated cardiomyopathy (DCM) and severe left ventricular (LV) dysfunction, left bundle branch block (LBBB), New York Heart Association (NYHA) class IV, received a biventricular implantable cardioverter/defibrillator (ICD) in 2002. Despite drug therapy, PVCs were frequent (21.019/24 h) including prolonged runs, prompting ICD intervention. Premature ventricular complexes showed an inferior axis morphology, with an R/S ratio in V3 > 1, suggesting an LVOT origin. Despite the cardiac resynchronization therapy (CRT) device, successful RFCA was performed through the anterior venous branch, with a favourable clinical outcome.
To our knowledge, this is the first case describing epicardial RFCA of a PVC focus from cardiac veins in the presence of a CRT device.

Introduction

The left ventricular outflow tract (LVOT) area can be a frequent source of isolated or repeated premature ventricular complexes (PVCs), resistant to drug therapy.[1,2] These arrhythmias can be detected in patients either with or without underlying heart disease. In highly symptomatic patients, an effective radiofrequency catheter ablation treatment can be performed, from endocardial or epicardial sites, both at the aortic cusps and more rarely from the tributaries of the coronary sinus.[3–6]

Case report

We report the case of a 50-year-old female, suffering from idiopathic dilated cardiomyopathy (DCM) with severe left ventricular (LV) dysfunction [LV ejection fraction 20% and New York Heart Association (NYHA) class IV]. She received a biventricular implantable cardioverter/defibrillator (ICD) in 2003 because of clinical episodes of sustained fast ventricular tachycardia (VT) and complete left bundle branch block (LBBB), with QRS duration of 140 ms. A 4F lead (Medtronic 4193, Minneapolis, MN, USA) was placed in the mid-portion of the lateral coronary vein. After biventricular ICD implant, despite optimized heart failure drug therapy and amiodarone, the patient reported several episodes of DC shocks from the ICD because of sustained monomorphic VTs. A successful radiofrequency catheter ablation (RFCA) of a VT circuit in the infero-apical LV region was performed in a first procedure without further inducibility of sustained ventricular arrhythmias. However, frequent PVCs were still present on subsequent Holter monitoring (21.019/24 h), with non-sustained runs of VT, and at least, six ICD shocks for prolonged VT episodes were detected at 6-month follow-up. Moreover, lack of improvement in heart failure symptoms and LVEF were possibly correlated with the irregular rhythm. Most of the PVCs and all prolonged VT runs showed the same inferior axis morphology, with a first low voltage positive deflection in the first precordial leads with an R/S ratio >1 in lead V3. These arrhythmias were the target of a further RFCA procedure.

After informed consent, an electrophysiological study was performed in the presence of frequent isolated PVCs and short runs of non-sustained VTs. Twelve-lead ECG and intracardiac electrograms filtered at 30–500 Hz were recorded. A 6F decapolar diagnostic catheter was placed in the right

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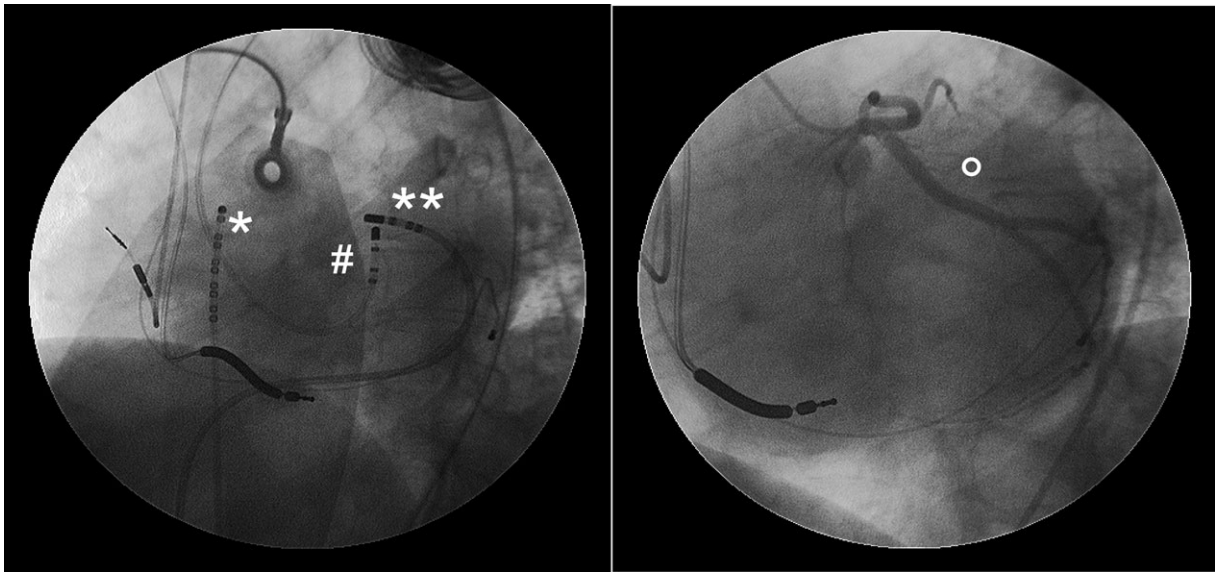

Figure 1 Left anterior oblique 45° projection: the RVOT catheter (asterisk), LVOT catheter (aortic approach, hash), and epicardial catheter (CS approach, double asterisk) are seen (left panel) with respect to coronary artery angiography (right panel). The ablation site is marked (°). Right atrial, RV, and LV leads of the biventricular pacing system are also evident.

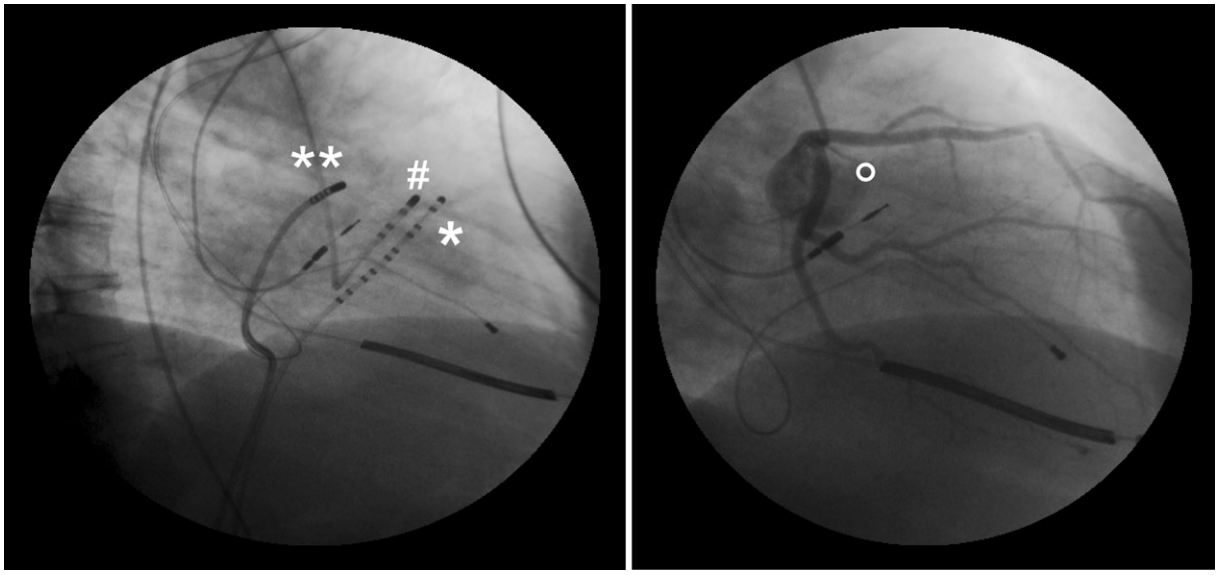

Figure 2 Right anterior oblique 45° projection: the RVOT catheter (asterisk), LVOT catheter (aortic approach, hash), and epicardial catheter (CS approach, double asterisk) are seen (left panel) with respect to coronary artery angiography (right panel). The ablation site is marked (°).

ventricular (RV) outflow tract, whereas a 4 mm, irrigated tip catheter (Celsius Thermo-Cool, Biosense-Webster, Diamond Bar, CA, USA) was used for mapping and ablation. The RV outflow tract was analysed with disappointing results in terms of prematurity and pace-mapping. As the *R*/*S* ratio >1 in lead V3 may suggest an LV PVC source, detailed mapping of the LV outflow tract was performed, starting from the anterior mitral valve aspect to the aortic cusps. Better results in terms of prematurity were evident compared with RVOT, but only 9/12 surface ECG lead concordance was detected on pace-mapping. Despite the presence of the biventricular device, epicardial mapping via the coronary sinus was then carefully attempted. Coronary angiography was also performed to localize the main arterial coronary branches and to minimize the risk of damage by RF ablation (*Figures 1* and *2*, right panel).

Successful PVC RFCA was performed using the epicardial approach through the great cardiac vein, following the detection of major prematurity of PVCs (-62 ms) and 11/12 surface ECG lead pace-mapping concordance (*Figure 3*), with RF power titration (starting at 10–20 W, three pulses of 1 min each). Complete and stable suppression of PVCs was obtained. No acute or peri-procedural complications were evident; at the 1, 3, and 6 month follow-up visits, no further ICD shocks had occurred. The LVEF and NYHA class improved, respectively, to 40% and class II, and the mean number of PVCs decreased to <100 daily, although the same anti-arrhythmic drugs were maintained.

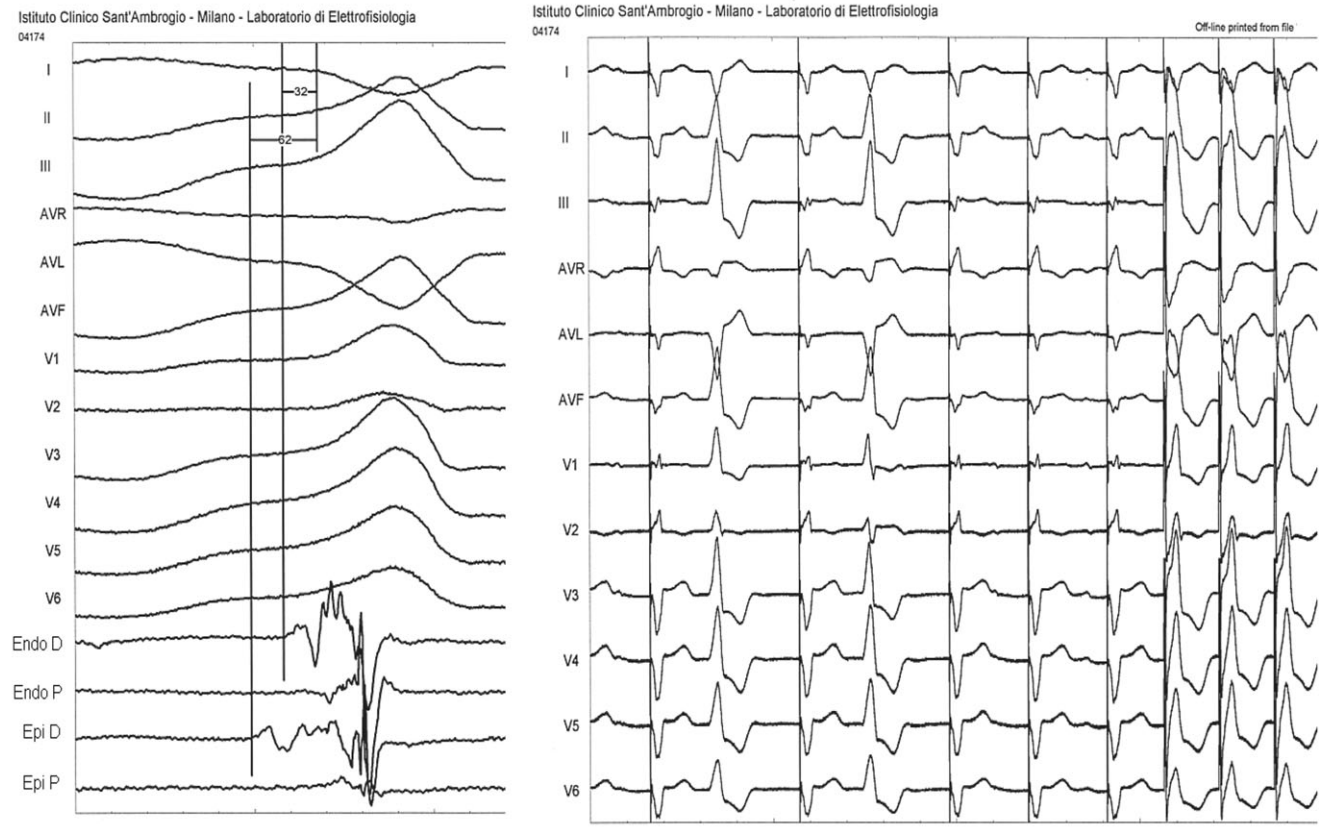

Figure 3 Left panel: better local prematurity (−62 ms) at epicardial (Epi, site of effective ablation) than endocardial (Endo) best recording (−32 ms) vs. PVCs-QRS onset. Right panel: pace-mapping from the epicardial ablation site, 11/12 concordance on surface ECG is evident.

Discussion

Ventricular arrhythmias arising from the epicardial site of the LV are quite common, and effective therapy with RFCA has been proposed either at the aortic cusps or via a pericardial percutaneous approach, although ablation through the coronary sinus has very rarely been described.[3–6] To our knowledge, this is the first case describing epicardial RFCA of PVCs from the coronary venous system in the presence of a transvenous biventricular device.

Role of non-sustained ventricular arrhythmias in the pathogenesis of LV dysfunction

Premature ventricular complexes are frequent in the presence of underlying heart disease and are the most common arrhythmias observed in patients without structural heart disease.[1] It has also been proposed that frequent PVCs may cause LV dysfunction that can be reversed by PVC suppression with anti-arrhythmic drugs or RFCA in patients with DCM. More recently, improvement in LV dilation and clinical status has also been described in patients without structural heart disease after successful ablation of frequent PVCs.[7]

In our case, idiopathic DCM with severe LV dysfunction, LBBB, and NYHA class IV presented, despite optimized drug therapy. Clinical and instrumental signs of heart failure improved after biventricular implant, with a further marked amelioration following PVC ablation. Both interventions played a role in this favourable outcome.

Prevalence of ventricular arrhythmias from epicardial sites

Premature ventricular complexes may frequently show a different origin from the RVOT, as assessed by effective RFCA procedures in 20–30% of all outflow tract ventricular arrhythmias.[1] In many cases, an LV source may arise from epicardial areas. Tanner *et al.*[5] have recently reported more than half of the global LV PVCs to emanate from epicardial sites. Although ECG criteria have been proposed to predict the source of PVCs, in most of these patients detailed electrophysiological mapping, with sequential analysis of RVOT, LVOT, and epicardial areas, is necessary to establish the exact location of the focus.[4,5,8] In our laboratory, as in the present case, epicardial RFCA through the coronary venous system is considered only after disappointing results with RV and LV endocardial mapping, whereas the pericardial percutaneous approach[9] is performed only in the case of failure of transvenous mapping.

An irrigated tip ablation catheter with energy titration was used to deliver RF into the cardiac veins. As proposed previously,[10,11] saline irrigation of the ablation electrode maintains a low electrode–tissue interface temperature, which prevents the sudden impedance rise that is not rare during RF ablation in the cardiac veins. Therefore, a nearly constant and stable amount of power can be delivered effectively for each application. The major concern with this kind of catheter is the risk of tamponade and coronary damage related to deeper lesions or 'pops'; in our

experience, accurate RF power titration strongly reduces the risk of these complications.

Furthermore, the present case is unusual because of the presence of a permanent biventricular pacing lead into the coronary sinus. The ablation was performed 15 months after this implant, a period that can be reasonably considered to warrant good stability of the pacing system. The presence of this lead, in our case, did not provide major difficulties in manipulating the catheter to reach the area for effective ablation. At the same time, ablation itself did not cause dysfunction of the lead either acutely or at mid-term follow-up. A percutaneous epicardial approach may, however, be considered as an alternative to minimize the risk of displacing the lead in similar cases.

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